



Early Steps Count: Teaching Arithmetic to Prepare Students for Algebra

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Teaching Subtraction

- How are all of these problems similar?
- How would you explain these problems if you were teaching second grade?

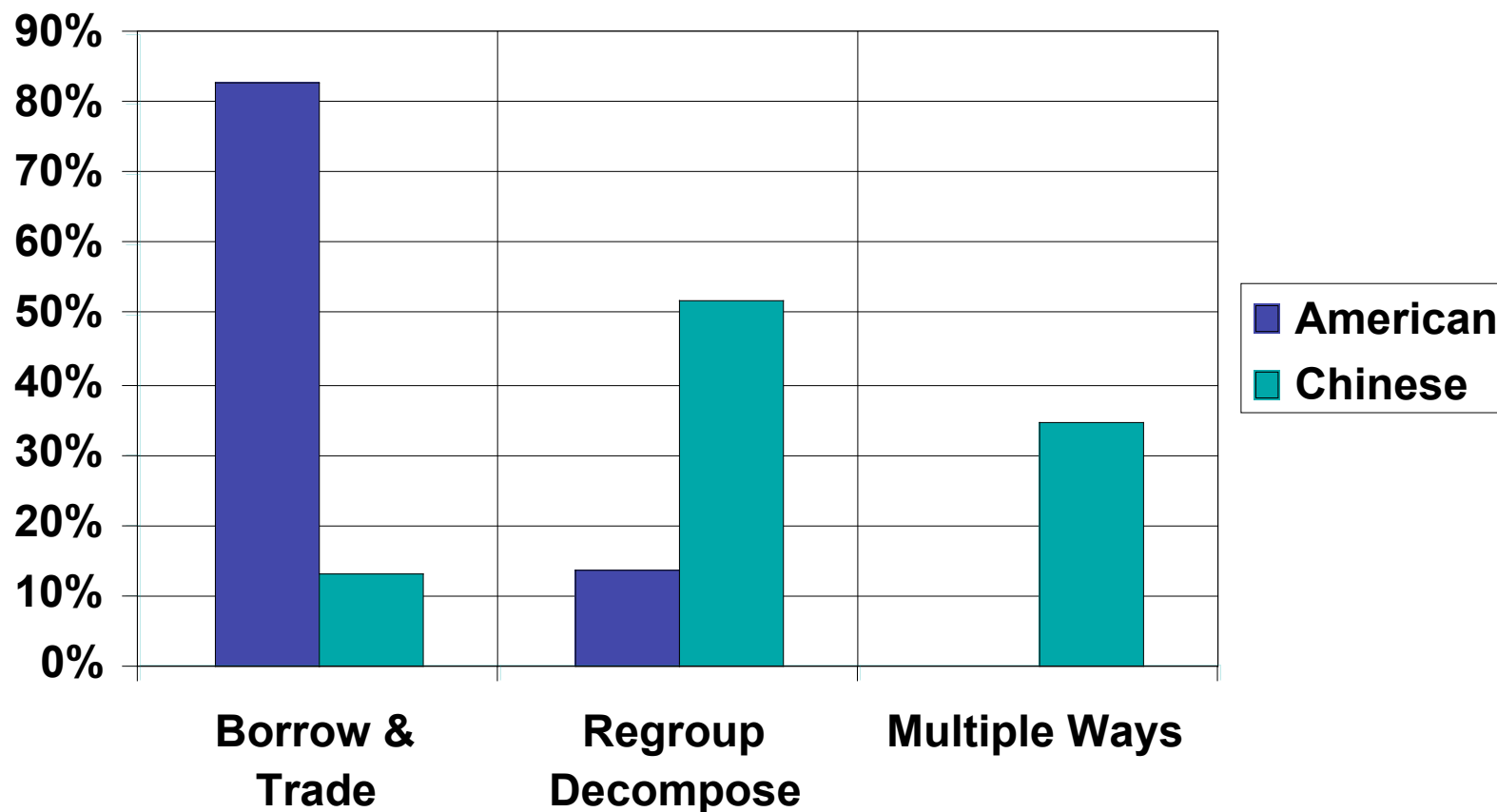
$$\begin{array}{r} 62 \\ -49 \\ \hline \end{array}$$

$$\begin{array}{r} 53 \\ -26 \\ \hline \end{array}$$

$$\begin{array}{r} 72 \\ -16 \\ \hline \end{array}$$

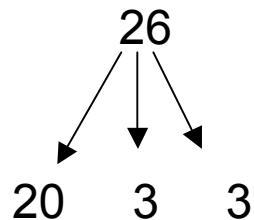
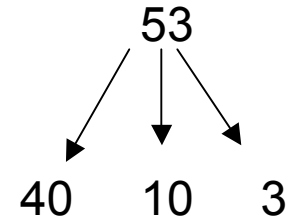
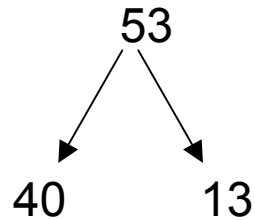
$$\begin{array}{r} 91 \\ -79 \\ \hline \end{array}$$

Ways of Teaching Subtraction



Knowing and Teaching; Ma, Liping; cc 1999;
Lawrence Erlbaum Ass. Inc.; pg. 8

Ways to Decompose



Conceptual and procedural understanding are intertwined



Practice in Decomposing

How can you decompose these numbers to complete the problem?

62

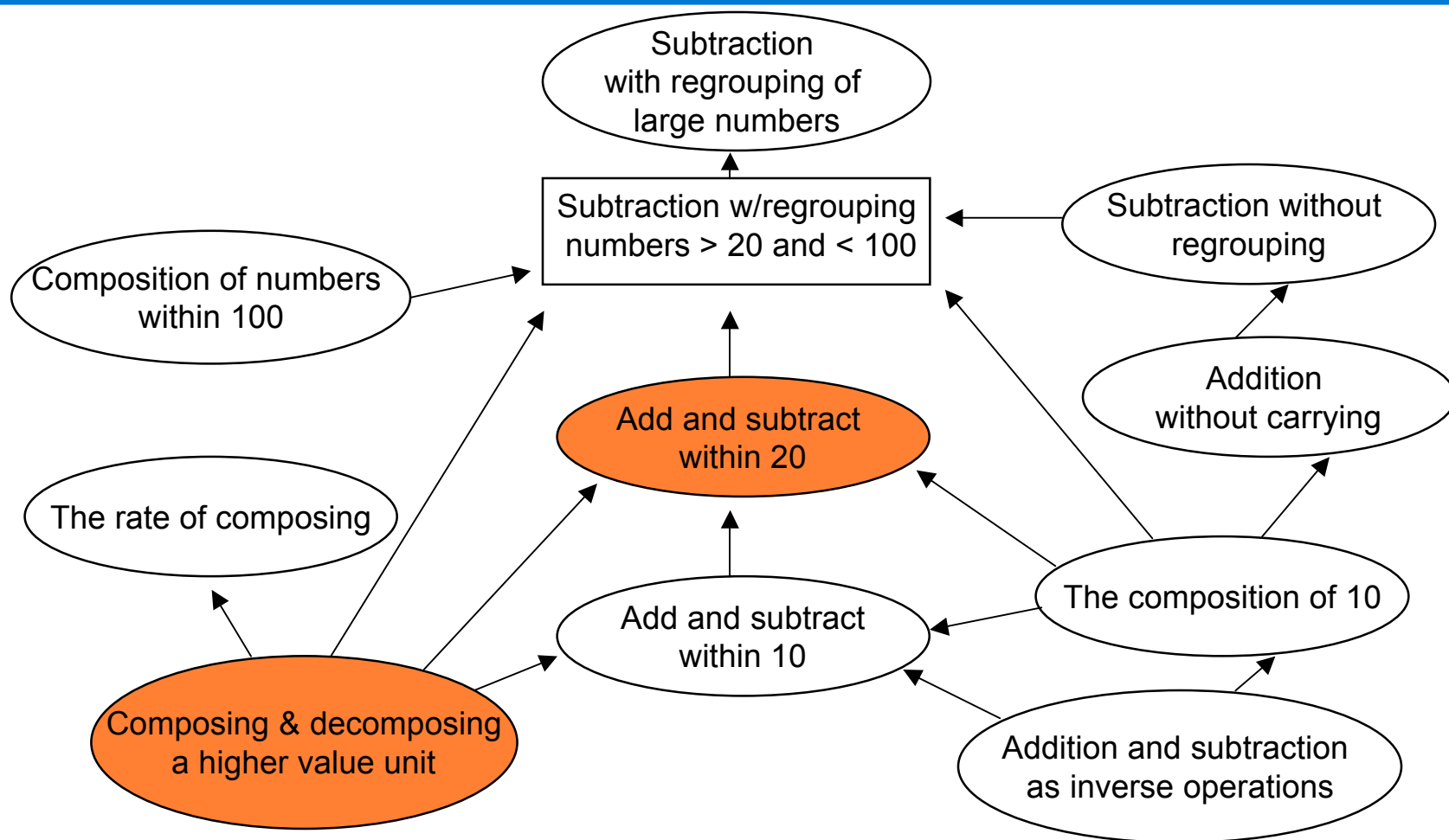
-49

How would you teach?

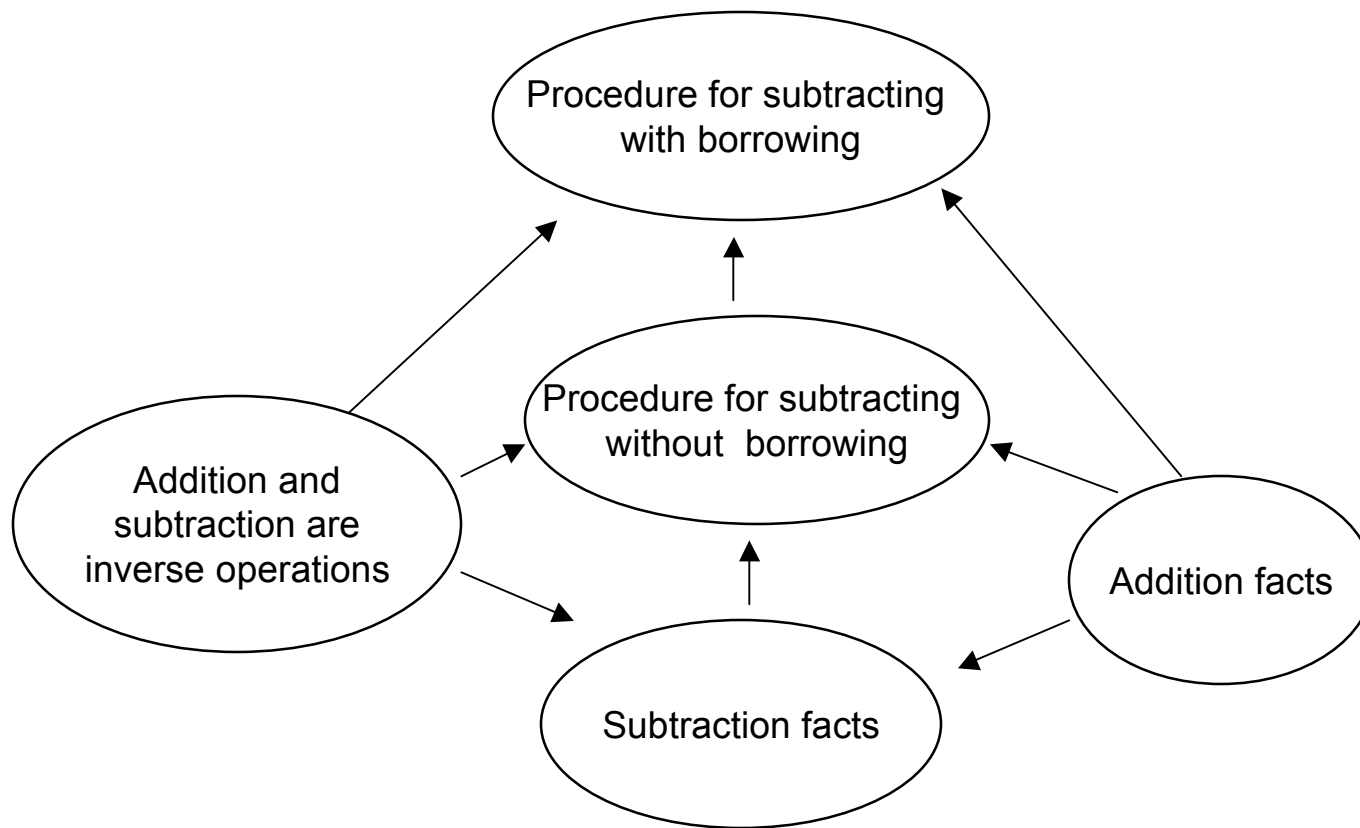
- **Most American teachers said they would use manipulatives in ways that paralleled their understanding**
 - Develop a concrete idea of subtraction
 - Build understanding of $1 \text{ ten} = 10 \text{ ones}$
 - One teacher wanted to build the idea of equivalent exchanges, which is equal to the Chinese idea of decomposing numbers.

Knowing and Teaching; Ma, Liping; cc 1999;
Lawrence Erlbaum Ass. Inc.; pg. 26

Knowledge Packet: Subtraction with Regrouping



Knowledge Packet for “Borrow and Trade” Approach



Multidigit Multiplication: Dealing with Student Mistakes



What do you do, when you get this:

$$\begin{array}{r} 123 \\ *456 \\ \hline 615 \\ 492 \\ \hline 738 \\ 1845 \end{array}$$

Instead of this?

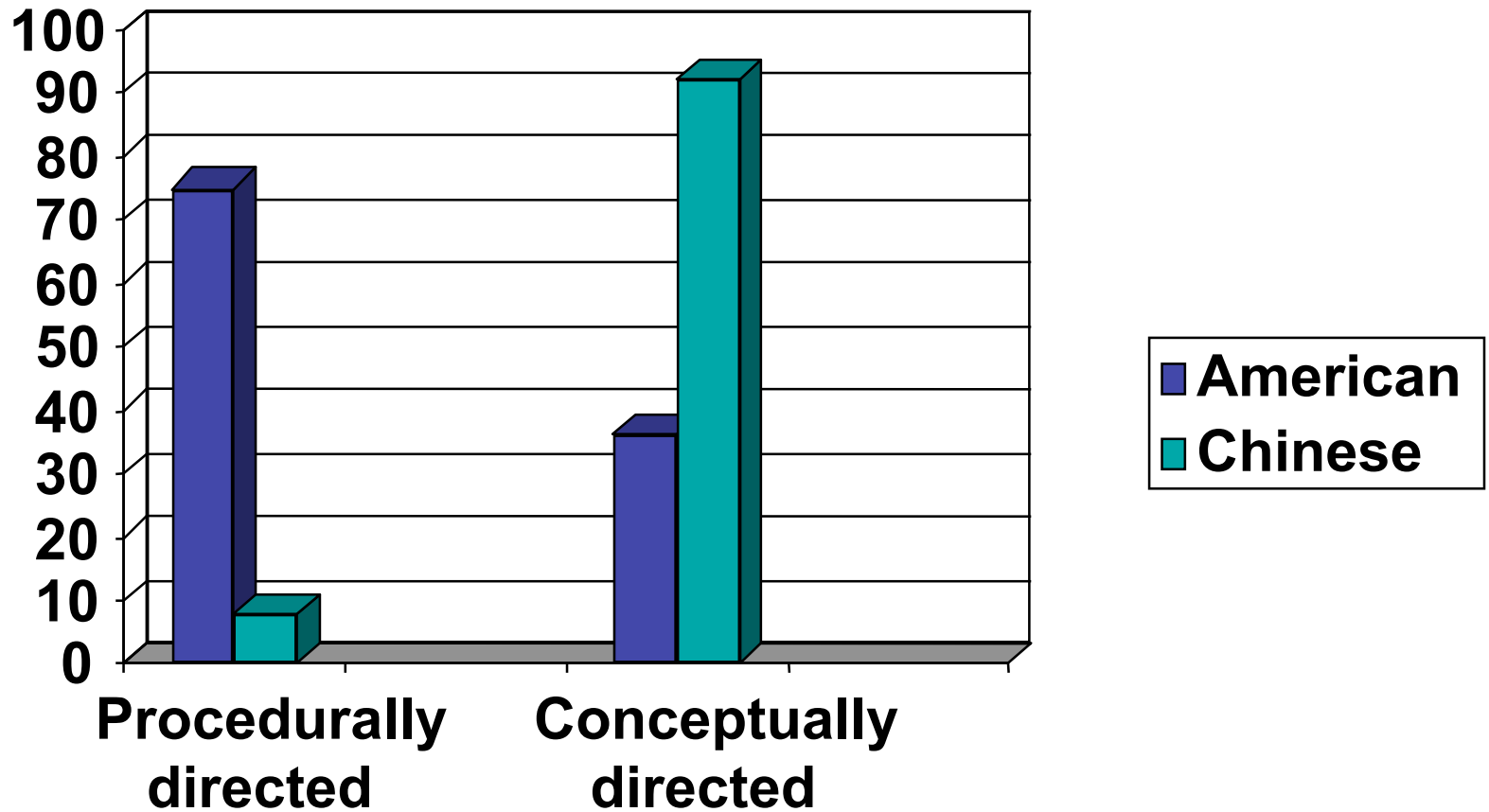
$$\begin{array}{r} 123 \\ * \quad \underline{456} \\ 738 \\ 492 \\ \hline \underline{615} \\ 79335 \end{array}$$

How did we explain it?



Procedural	Conceptual

Teaching Strategies



Tr. Chen's Approach



$$\begin{array}{r} 123 \\ * \quad \underline{456} \\ 492 \\ 738 \\ \quad \underline{615} \\ 79335 \end{array}$$

Challenge: Find other ways to align the problem so that it is correct.



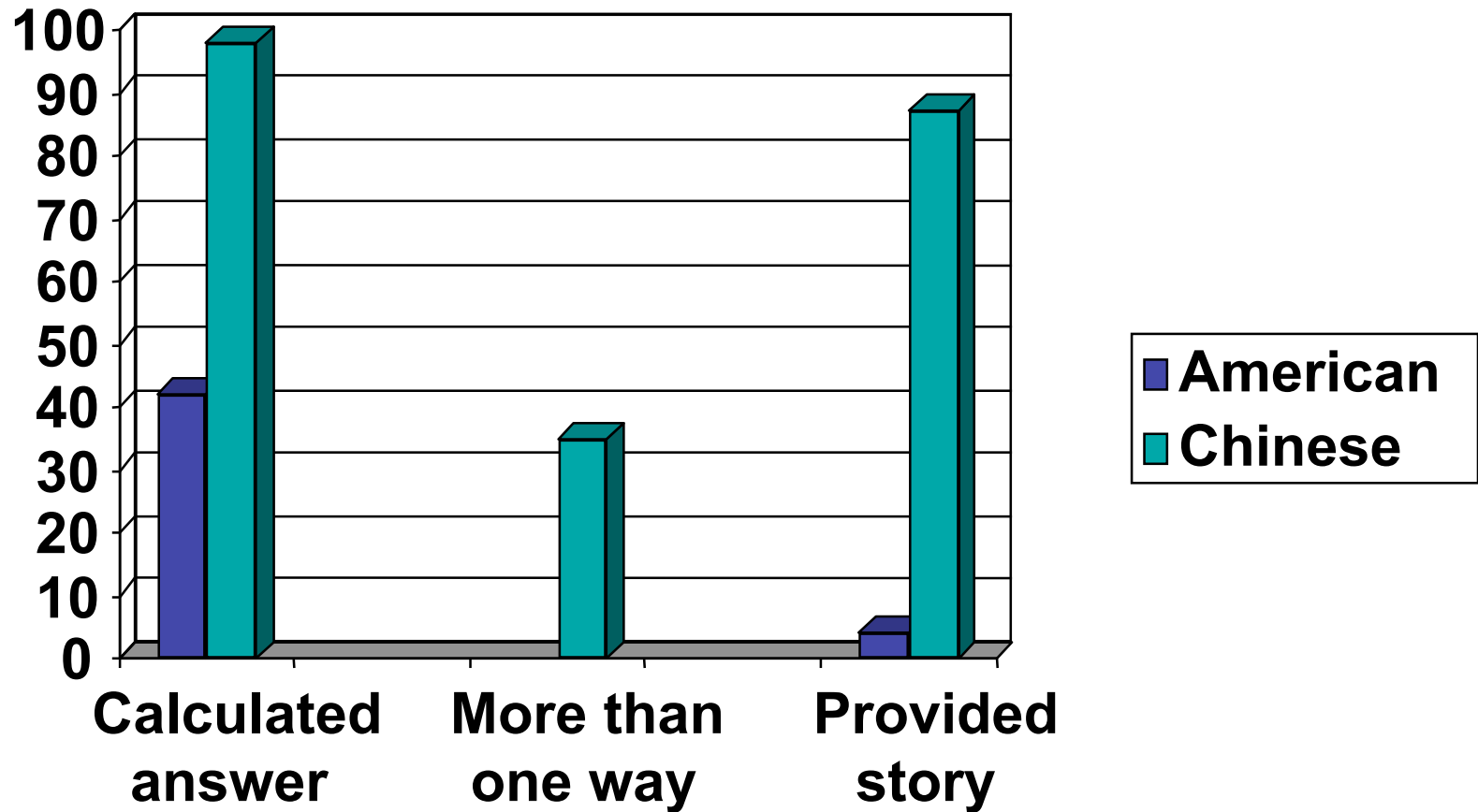
Division of fractions

$$1 \frac{3}{4} \div \frac{1}{2}$$

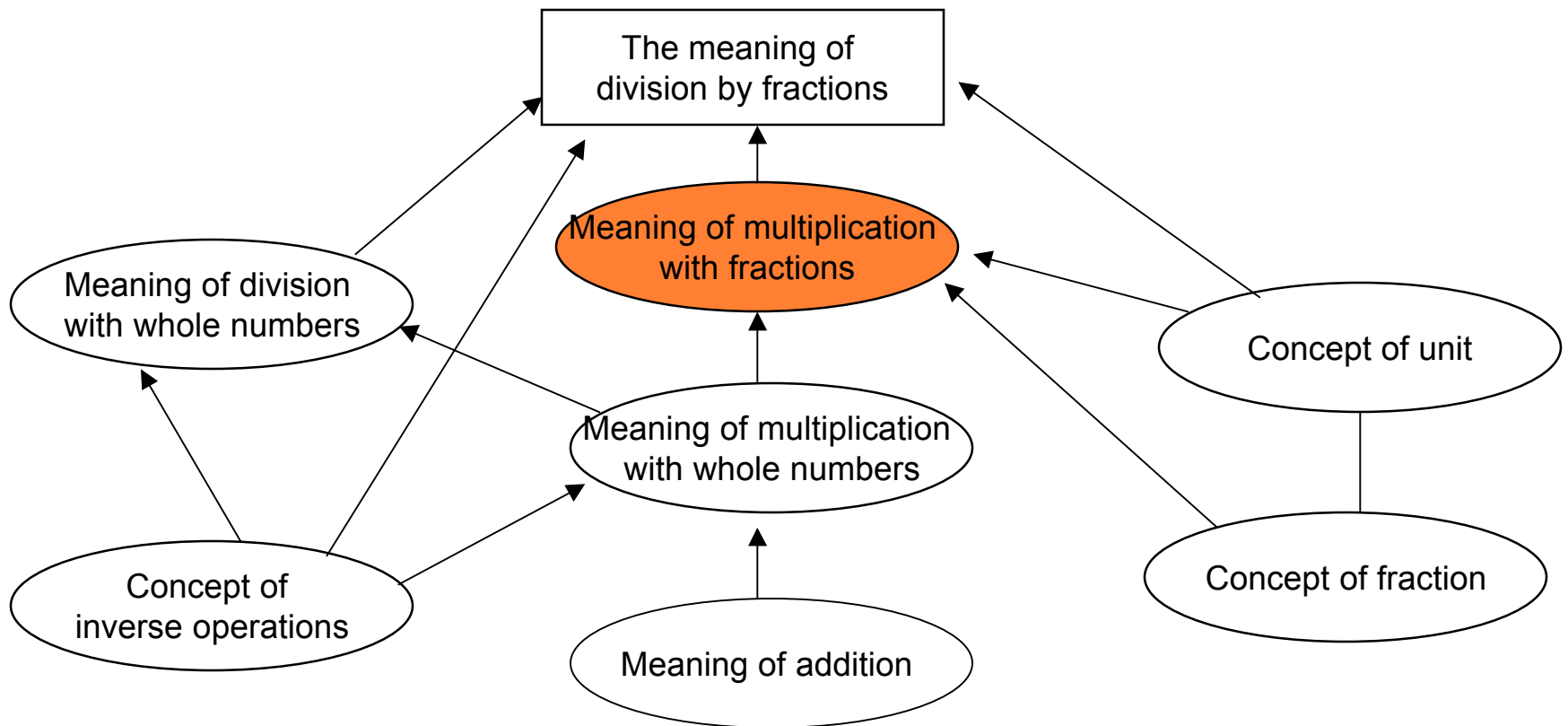
People solve this problem in different ways. How do you solve it? Can you solve it in more than one way?

Imagine you are teaching fractions. What is a story you would make up to fit with this problem?

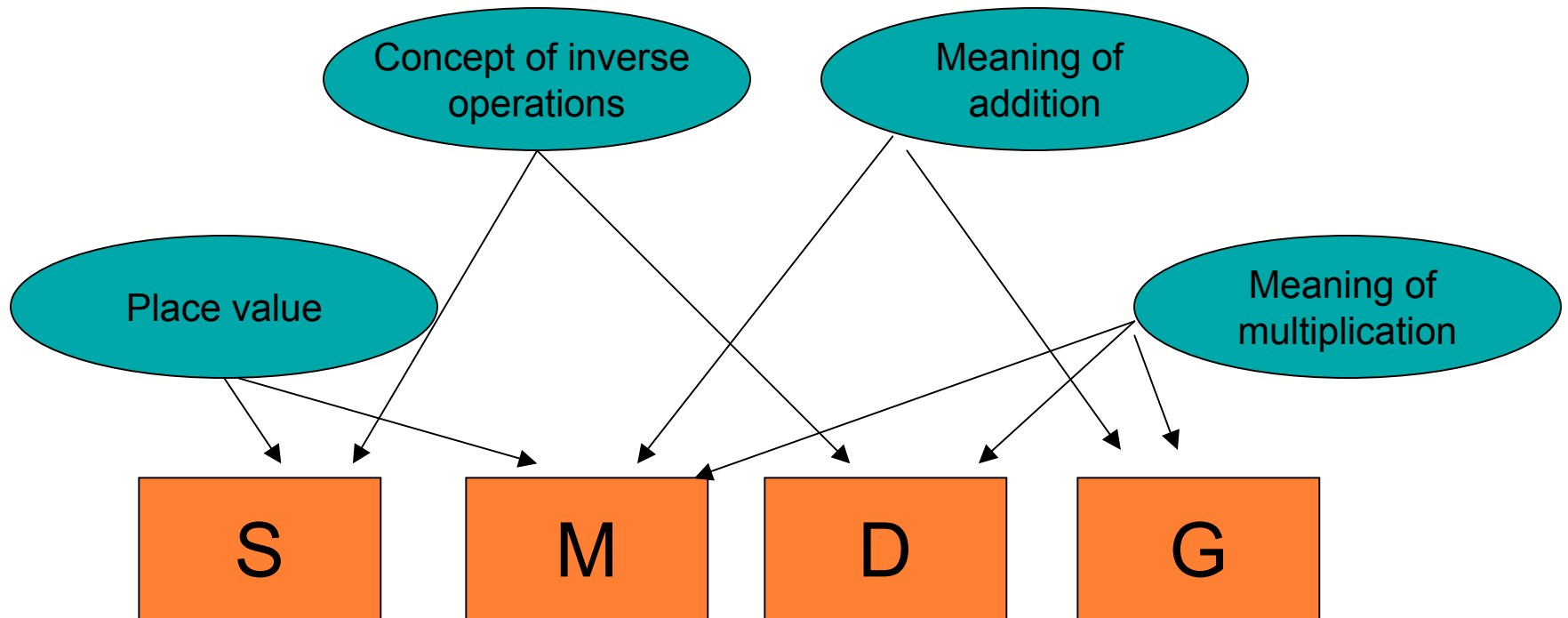
Teacher's Knowledge of Division by Fractions



Knowledge Packet for Dividing by Fractions



Profound Understanding of Fundamental Mathematics





Review Procedure for Division

■ In your handout packet

- Is this approach more procedural or conceptual?
- Which algebraic concepts does it support?
- How could it be enhanced to better support algebraic thinking?
- Would you use this approach? Why or why not?

Final Points



- **Americans talk about basic math; Chinese talk about fundamental mathematics.**
- **How children are taught elementary mathematics sets them up for success or failure in Algebra.**
- **The knowledge gap between American and Chinese teachers parallels the learning gap between American and Chinese children.**



Fall extension

- **I will post lessons. As a group, we will discuss ways to strengthen the algebraic connections.**
- **You will take one lesson from your text, identify the core math that is being taught and identify the algebraic concepts that could be included. You will post this lesson and your comments about how you could teach it.**